A Recommendation on New Academic Infrastructure

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As a component of the stimulus program we recommend the creation of a statewide academic network for distance learning, assessment, professional development, and curriculum development and dissemination. As envisioned, the network would, like roads and libraries, be operated by the state as a component of its academic infrastructure. *Thus there would be no cost to schools or teachers for use of the network*[1]. Although we mention a number of applications of the network we emphasize that the recommendation is on the creation of a unique, common resource to which all Kentucky educators and educational institutions would have equal access and from which all have multiple opportunities to benefit.

The architecture of the network would be such that services (e.g. synchronous distance learning) could independently originate from and resources be freely accessed in any Kentucky classroom, or academic office. It would provide all Kentucky teachers with advanced local tools for automatically checking routine homework and managing the data. The same infrastructure would provide a common platform for securely and quickly administering and managing standards-based state (or local) accountability assessments, end-of-course assessments, college placement exams, workplace qualifications, etc. It would provide a major component of the kind of longitudinal "pre-K through college and career data system to track progress and foster continuous improvement" required in *Guidance on the State Fiscal and Stabilization Fund Program*[2] , (p. 4). At the same time it would provide a common interface through which teachers, schools, parents, colleges, and employers could collaborate to actually implement the required continuous improvement infrastructure. . It would also provide, as a corollary, a vehicle for the rapid implementation of a Kentucky version of the California system Early Assessment Program[3] (EAP) through which CSU collaborated with the schools to achieve in one year (and to since maintain) a 20% reduction in the mathematics remediation rate for the entire system.

The distance learning tools and open access of the network allow the projection of instructional services from any point on the network to any other. In contrast to the very challenging problem of equitable distribution of scarce teachers, this provides a viable approach to the equitable distribution of scarce *teaching services* which can be implemented quickly and cheaply, even on a local basis.

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[1] The impact of a freely available, common utility of this type can be seen in the explosion of creativity and innovation that followed the free availability of the technical infrastructure on www.mathclass.org . Among these is a large partnership among NKU and 18 Northern Kentucky school districts aimed directly at the reduction of remedial instruction. NKU has suggested that an adaptation of that program be part of the recommendations for the College Readiness subcommittee. Their document is at https://www.mathclass.org/WebPages/Pages/256/KYOTE_NKU_Proposal.pdf

[2] http://www.ed.gov/programs/statestabilization/guidance.doc
It would also directly address each of the other three required commitments on page 4. We won't take the time to provide them but those details can be provided at an y time.

[3] Jones, A. (2007, October). *The California State Early Assessment Program*. Presented at Achieve, ACE, NASH, SHEEO. Washington, D.C. Retrieved December 19, 2008 from http://www.mathclass.org/WebPages/Pages/201/jonesACR07.pdf Jones also reports there on a website (http://www.csumathsuccess.org/mshome)which provides a support and planning system for future CSU students, their parents, teachers, and counselors.

The system technology has been created and manufactured by the University of Kentucky (software) and Lexmark[4] (hardware). The major components are employed "in production". The UK system has been fully operational and under constant development since 2000. Its major implementation is at www.mathclass.org where its services include daily instructional support for 5000 math and Spanish students, the KEMTP[5], and the KYOTE[6] placement system, distance learning instruction[7], and professional development for teachers[8],[9],[10]. The Lexmark Education Station[11] is a high-end printer/scanner, first released in 2007, which also creates and checks multiple-choice answer forms. An interface, developed through aUK-Lexmark collaboration provides an interface between the two systems to create the infrastructure for the network.

Size/Cost/Sustainability

Any Kentucky academic institution would be able to operate a node on the network but the expectation would be that most would take advantage of a small number of large nodes operated at universities or state agencies. Five the size of the UK math class system would suffice for the entire state with ample redundant capacity. Based on the UK system we estimate that the equipment startup costs for these (the servers, software, backup systems, etc) would cost a total of about $100,000. Operations including help desk, backup, security, etc. for the five) would total about $250,000 per year and the continuing research and development operations on the server system and system updates would cost about $150,000 per year. The Lexmark devices would cost about $4,000 each[12]. Thus a rough estimate for a 1000 node network would be $4 million (essentially all in startup costs for the Lexmark hardware[13]) plus $400,000 annual operations and improvement costs. As already noted, the hardware provides a school with duplication, scanning, and fax services and replaces Scantron systems and their expensive grading forms. These would largely offset replacement cost of the hardware.

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[4] Lexmark's headquarters and primary development center are in Kentucky.

[5] http://www.mathclass.org/kemtp-info/ -> Goto KEMTP

[6] https://www.mathclass.org/WebPages/Pages/173/KYOT.pdf

[7] Roher, L. A. H. (2007, February 25). Access to algebra: Comparative study of high school math students using distance learning at readiness with college algebra classroom students. Presented at the 2007 Tenth Special Interest Group of the Mathematical Association of America on Research in Undergraduate Mathematics Education, San Diego, CA.

[8] Eakin, P., & Roher, L. A. H., (2007, October 29). *A model for embedded PD for secondary mathematics teachers*. Presented at the 2007 Quality Teacher Summit, Frankfort, KY.

[9] https://www.mathclass.org/WebPages/Pages/196/talk_slidesLf.pdf

[10] Roher, L. (2009). *The relationship between the degree of participation in online embedded* professional development for high school mathematics teachers and student achievement in college algebra. Ph.D dissertation, University of Kentucky, spring 2009.

[11] http://www.lexmark.com/lexmark/product/home/393/0,6970,204816596_653399449_1020710281_en,00.html?tabId=1

[12] In principle a school could use the network entirely electronically. However there are serious logistics and even equity issues in administering electronic assessments to students which can be completely avoided by using intermediate hard-copies. In addition, the local hard-copy device provides duplication and scanning and provides all of the local services of, for instance, a Scantron system.

[13] The current UK node operates with no such hardware and indeed one could implement the "online" services without the printer/scanners. However, given of their far less complex assessment environments the resulting system would then be proportionally be of greater utility to the higher education community.